

LIFE IN EXTREME ENVIRONMENTS (LE_xEn)

*Announcement of Opportunity and
Special Competition for FY 1998*

DIRECTORATE FOR BIOLOGICAL SCIENCES
DIRECTORATE FOR ENGINEERING
DIRECTORATE FOR GEOSCIENCES
DIRECTORATE FOR MATHEMATICAL AND PHYSICAL SCIENCES
OFFICE OF POLAR PROGRAMS

DEADLINE DATE: *January 15, 1998*



NATIONAL SCIENCE FOUNDATION

Introduction

Life flourishes on Earth in an incredibly wide range of environments, from high-salt deserts to volcanoes to polar ice. These environments may be analogous to the harsh conditions that exist now, or have existed, on other planets. The study of microbial life-forms and the extreme environments in which they exist here on Earth can provide important new insights into how organisms form and adapt to diverse environments. This knowledge will provide the basis for detecting and understanding the life forms that may exist beyond our own planet, and for developing useful new products and processes.

The Directorates for Biological Sciences (BIO), Engineering (ENG), Geosciences (GEO), Mathematical and Physical Sciences (MPS), and the Office of Polar Programs (OPP) of the National Science Foundation (NSF) announce an opportunity to enhance knowledge about "Life in Extreme Environments" (LExEn) through highly interdisciplinary, integrated research activities.

LExEn Interdisciplinary Research Program

The LExEn interdisciplinary research program will explore the relationships between microorganisms and the environments within which they exist, with a strong emphasis upon those life-supporting environments that exist near the extremes of planetary conditions. In addition, the LExEn program will explore planetary environments in our own solar system and beyond to help identify possible sites for life elsewhere.

Research is required to enhance understanding of the microbial systems on Earth, particularly with respect to their diversity and the mechanisms that allow microbes to survive and alter extreme environments. Examples of relevant topics include:

- studies to discover, quantify, culture, preserve, and analyze microorganisms from extreme environments;
- research on the diversity, ecology, physiology, biochemistry, genetics and evolutionary history of microbes from extreme environments within the context of the diversity of conditions found in those environments and/or their possible utility in biotechnology;
- the identification of unusual or even unique chemical compounds and their specific roles in survival strategies; and
- paleobiological studies of microbial life on Earth, including efforts which improve understanding of the products of life that are preserved in the geological record.

Because of the importance of the interactions between living organisms and their habitats, it is necessary to achieve improved understanding of present-day or past extreme environments that support or have supported life.

Examples of relevant topics include studies designed to explore and fully characterize significant examples of extreme environments in order to understand the active physical, chemical, biological and geological processes that determine their characteristics and result in their ability to support unusual microbial life. In order to provide insights into the possibility of life beyond our own planet, research is also needed to characterize the environments of planets in the solar system and beyond and to understand the commonalities of their formation and evolution. Examples of relevant topics include studies of the formation of Earth, other planets and their satellites; remote sensing of planets and their atmospheres; studies of interstellar grains and meteorites to establish criteria for the presence of biogenic substances; and research on the biogeochemical effects of microbes on their environments on Earth to better design tests for life on other planets.

FY 1998 Special Competition

NSF is highlighting its interest in LExEn through a special competition as described below. Proposals must be received at NSF no later than close of business on January 15, 1998. Review and processing of proposals require approximately six months.

For the purposes of this announcement "extreme" refers to environments found today on Earth which have attributes that are similar to those that exist on other planetary bodies (at present or in the past), or to those that are postulated to have existed on Earth at the dawn of life. Such environments might include those associated with hydrothermal systems, sea ice and ice sheets, anoxic habitats, hypersaline lakes, high altitude or polar deserts, or man-made environments such as those created for industrial processes.

It is intended that this Special Competition will focus on hypothesis-driven projects that show potential for establishing a foundation for future innovative research related to LExEn. Because of the importance of the interactions between living organisms and the extreme environments within which they exist, studies are particularly encouraged that cross disciplinary boundaries and foster collaborative investigations.

For this Special Competition, projects should couple one or more of the research areas described in the previous section with the development and application of one or more of the following:

- methods to isolate and culture microbes found in extreme environments;

- methods to study these microbes in their natural habitats and to describe their adaptive strategies from the molecular to the ecological level;
- technologies for non-contaminating sample recovery;
- sensors and sensing techniques to probe extreme environments on Earth or other planets;
- methods to study ancient microbial life and paleo-environmental conditions on Earth; and
- methods to investigate the potential for habitable environments on other planets (including theory and modeling).

Research projects of 2-5 years duration are appropriate. Proposals that are predominantly for the purchase of available equipment or instrumentation are not appropriate for this competition. Funds available to support projects under this Special Competition are expected to total approximately \$6 million. NSF anticipates making approximately 20 awards in fiscal year 1998 depending on the quality of the proposals received and the availability of funds.

Preparation and Submission of Proposals for the FY 1998 Competition

Proposals submitted in response to this Announcement of Opportunity will be accepted from colleges, universities, and other non-profit institutions in the United States. Proposals involving collaboration with researchers and facilities of other countries or international groups are welcome, provided support is requested only for the U.S. portion of the collaborative effort.

Proposals should be prepared and submitted in accordance with the NSF *Grant Proposal Guide (GPG)* NSF 98-2 and the *Proposal Forms Kit* NSF 98-3 (replacing NSF 95-27 and NSF 95-28). For proposals involving field work in Antarctica, guidelines described in the "Antarctic Research Opportunities and Proposal Guide" NSF 96-93 should be followed. These documents can be accessed through the NSF Home Page (<http://www.nsf.gov/>) or you may request hard copies at no cost from:

NSF Clearinghouse
P.O. Box 218
Jessup, MD 20794-0218
TEL: 301-947-2722
e-mail: pubs@nsf.gov

Proposers requiring the use of a UNOLS ship or submersible must submit a ship request form to NSF's Division of Ocean Sciences as well as the UNOLS office and the operator of any requested ship or ships.¹

¹ Electronic ship request forms are available on the UNOLS Home Page (<http://www.gso.uri.edu/unols/experiments/experiments.html>). Printed copies of

Proposals will be subjected to initial screening for the requirements in the *GPG* and will be returned without review or advance notification if deficiencies are found. Proposals will NOT be forwarded to other programs if found to be inappropriate for this competition. Proposals submitted in response to this announcement must be received at NSF no later than close of business on January 15, 1998.

Group and collaborative proposals involving more than one institution MUST be submitted as a single administrative package from one of the institutions involved. Multiple submissions will not be accepted. (The proposal may be split into separate awards if the project is recommended for support.) The package should include one project summary, one table of contents, one project description, one section for references, and one copy of special information and appendices as specified in *GPG* section II.D.10-11. Additionally, the package should include, for each university and its PIs/co-PIs, a signed cover sheet, budget pages and explanation, results from prior NSF support (up to 2 pages per person), biographic sketches (up to 2 pages per person), current and pending support for each PI/co-PI, and facilities and other resources unique to each institution.

LEExEn should be referenced in the upper left corner of the proposal cover sheet as the NSF organizational unit. The solicitation number is NSF 97-157. An original and 20 copies of the proposals should be sent to:

Announcement No. NSF 97-157
Proposal Processing Unit
National Science Foundation
4201 Wilson Blvd., Room P-60
Arlington, VA 22230

Proposals may also be submitted electronically via Fastlane. For information, contact FastLane user support services (tel: 703-306-1142; email: fastlane@nsf.gov).

Proposal Review

Proposals will be evaluated by ad hoc mail and panel review in accordance with established Foundation procedures and the criteria described below. It is anticipated that each review panel will have expertise in the fields of astronomy, planetary sciences, chemistry, geochemistry, biology, atmospheric sciences, earth sciences, ocean sciences, polar sciences, and engineering.

Proposals submitted in response to this program announcement will be subject to the NEW merit review criteria approved by the National Science Board on March 28, 1997 (NSB97-72).² The new merit review criteria are:

the form may be obtained from NSF Division of Ocean Sciences or the UNOLS office (tel: 401-874-6825; email: unols@gso.uri.edu).

² For additional information on NSF's new merit review criteria, see the Merit Review Task Force Final Report on the NSF Home Page at <http://www.nsf.gov/cgi-bin/getpub?nsbmr975>.

- **What is the intellectual merit and quality of the proposed activity?**

For example, how important is the proposed activity to advancing knowledge and understanding within its own field and across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, reviewers may also comment on the quality of prior work.) To what extent does the proposed activity suggest and explore creative and original concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

- **What are the broader impacts of the proposed activity?**

For example, how well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

In addition to these generic review criteria, an additional criterion in the evaluation process for this competition will be the potential interdisciplinary synergism among the various research components. For this reason, the ways in which the various projects proposed will be divided and coordinated among the different researchers needs to be carefully thought out and described.

Grant Administration and Conditions

Grants awarded as a result of this announcement will be administered in accordance with the terms and conditions of NSF GC-1 (10/95) or FDP-III (7/1/96), *Grant General Conditions*. Copies of these documents are available from the NSF online document system: <http://www.nsf.gov/cgi-bin/pubsys/browser/odbrowse.pl>. More comprehensive information is contained in NSF 95-26, *Grant Policy Manual* (7/95), for sale through the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

FY 1999 and Beyond

The nature of future LEXEn special competitions is still under consideration. Future announcements will be posted electronically with hard copies available upon request. If you would like to be alerted to the posting of these announcements, please send a message to "listmanager@nsf.gov" with the command "subscribe nsflexen <your full name>" in the text of the message (the subject line is ignored). Your e-mail address will be extracted from the "From:" field of your request.

For More Information

This announcement, as well as other LEXEn-related information, is available on-line at <http://www.nsf.gov/home/crssprgm/lexen/start.htm>. Should you wish to receive a hard copy of this announcement, please contact the NSF publications office (tel: 301-947-2722; email: pubs@nsf.gov).

If you have questions or require further information, contact:

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The National Science Foundation provides awards for research and education in the sciences and engineering. The awardee is wholly responsible for the conduct of such research and preparation of the results for publication. The Foundation, therefore, does not assume responsibility for the research findings or their interpretation.

The Foundation welcomes proposals from all qualified scientists and engineers and strongly encourages women, minorities, and persons with disabilities to compete fully in any of the research and education related programs described here. In accordance with federal statutes, regulations, and NSF policies, no person on grounds of race, color, age, sex, national origin, or disability shall be excluded from participation in, be denied the benefits of, or be subject to discrimination under any program or activity receiving financial assistance from the National Science Foundation.

Facilitation Awards for Scientists and Engineers with Disabilities (FASSED) provide funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on NSF projects. See the program announcement or contact the program coordinator at (703) 306-1636.

The National Science Foundation has TDD (Telephonic Device for the Deaf) capability, which enables individuals with hearing impairment to communicate with the Foundation about NSF programs, employment, or general information. To access NSF TDD, dial (703) 306-0090; for FIRS, 1-800-877-8339.

Privacy Act and Public Burden

The information requested on proposal forms is solicited under the authority of the National Science Foundation Act of 1950, as amended. It will be used in connection with the selection of qualified proposals and may be disclosed to qualified reviewers and staff assistants as part of the review process; to applicant institutions/grantees; to provide or obtain data regarding the application review process, award decisions, or the administration of awards; to government contractors, experts, volunteers, and researchers as necessary to complete assigned work; and to other government agencies in order to coordinate programs. See Systems of Records, NSF 50, Principal Investigators/Proposal File and Associated Records, and NSF-51, 60 Federal Register 4449 (January 23, 1995), Reviewer/Proposal File and Associated Records, 59 Federal Register 8031 (February 17, 1994). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of your receiving an award.

The public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Gail A. McHenry, Reports Clearance Officer, Information Dissemination Branch, National Science Foundation, 4201 Wilson Boulevard, Suite 245, Arlington, VA 22230.

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